

What is claimed is:

1. A substrate treatment apparatus for removing an unnecessary substance from a surface of a substrate, the apparatus comprising:
  - 5 an oxidation liquid supply mechanism for supplying an oxidation liquid having an oxidative effect to the substrate surface;  
a physical cleaning mechanism for physically cleaning the substrate surface; and
  - 10 an etching liquid supply mechanism for supplying an etching liquid having an etching effect to the substrate surface.
2. A substrate treatment apparatus as set forth in claim 1, further comprising a cleaning controller for  
15 controlling the oxidation liquid supply mechanism and the physical cleaning mechanism to physically clean the substrate surface while supplying the oxidation liquid to the substrate surface.
3. A substrate treatment apparatus as set forth in  
20 claim 1, wherein the physical cleaning mechanism comprises a dual fluid spray nozzle for blowing a gas on a treatment liquid ejected toward the substrate surface to generate a jet flow of droplets of the treatment liquid and supplying the jet flow to the substrate surface.
- 25 4. A substrate treatment apparatus as set forth in

claim 1, wherein the physical cleaning mechanism comprises an ultrasonic mechanism for imparting ultrasonic vibration to a treatment liquid supplied or to be supplied to the substrate surface.

5 5. A substrate treatment apparatus as set forth in claim 1, wherein the oxidation liquid supply mechanism supplies a treatment liquid comprising ozone water as the oxidation liquid to the substrate surface.

6. A substrate treatment apparatus as set forth in  
10 claim 1, wherein the oxidation liquid supply mechanism supplies a treatment liquid comprising hydrogen peroxide as the oxidation liquid to the substrate surface.

7. A substrate treatment apparatus as set forth in  
15 claim 1, wherein the physical cleaning mechanism applies a physical energy to the oxidation liquid supplied or to be supplied to the substrate surface by the oxidation liquid supply mechanism.

8. A substrate treatment method for removing an unnecessary substance from a surface of a substrate, the  
20 substrate treatment method comprising the steps of:

supplying an oxidation liquid having an oxidative effect to the substrate surface for oxidizing metal impurities on the substrate surface;

physically cleaning the substrate surface; and

25 supplying an etching liquid having an etching effect

to the substrate surface for etching the substrate surface after the oxidation step and the physical cleaning step.

9. A substrate treatment method as set forth in claim 8, wherein the physical cleaning step is carried out at  
5 least partly simultaneously with the oxidation step.

10. A substrate treatment method as set forth in claim 8, wherein the oxidation step, the physical cleaning step and the etching step are repeated a plurality of times.

11. A substrate treatment method as set forth in claim  
10 8, wherein the etching step is carried out for a period necessary and sufficient to etch away the metal impurities oxidized in the oxidation step.